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(54) **NAVIGATION INFORMATION SYSTEM**
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Description

This invention relates to navigation information systems. It is particularly suitable for use in providing users of road vehicles with route guidance, but other applications are possible and are discussed below.

Navigation of a vehicle through an unfamiliar complex road network is a difficult task. Large amounts of fuel and time are wasted as a result of drivers getting lost or using an inefficient route. Accidents can also be caused by drivers attempting to read maps or complex road signs and losing concentration on the road ahead. Moreover, a driver may choose an inefficient route as a result of using an out-of-date map.

An additional problem can occur even if a driver knows a route to his or her destination. That route may be congested or blocked as a result of accidents or maintenance work, so that an alternative route would be more efficient.

Several proposals have been made for navigation guidance systems. In some such proposals a vehicle-borne system has a navigation computer and a geographical information system which is essentially a digitised map stored on a CD-ROM. The system gives the driver information and guidance by screen and/or speech display. These systems would be very expensive. Each vehicle requires a navigation computer and geographical information system. The cost of the complex vehicle-borne equipment involved is estimated to be in the region of £1000. The system is complex to operate, and could only be safely operated by the driver whilst the vehicle is stationary. The geographical information system would require periodic updating, which requires new disks to be distributed to subscribers from time to time.

In some proposed systems of this type real-time data would be broadcast over a radio network to update fixed information held on the geographical information system. Even so, the geographical information system would only be accurate up to its last update. Moreover, a broadcast channel needs to be allocated for the updating service.

It has also been proposed that the guidance service provider collects statistical traffic flow data from which traffic congestion predictions can be made which are fed into the real-time data to be broadcast. The traffic flow data may be collected using roadside sensors, or they may be collected by monitoring the operation of the mobile user equipment. The latter approach can only collect data relating to users of the system, but has a lower capital cost.

In an alternative approach a system of short-range roadside beacons is used to transmit guidance information to passing vehicles equipped with simple transceivers. The beacons transmit information to suitably equipped passing vehicles to give turn instructions appropriate to their chosen destinations. For each beacon the territory to be covered is divided into as many zones as there are exits from the junction the beacon relates to. The zone in which th user's chosen destination falls is determined, and instructions are given appropriate to that zone. At any given beacon all vehicles whose destinations are in the same zone get the sam instruction. The definitions of the zones are dependant on the location of the beacons, and each zone comprises the set of destinations which should be reached from the beacon by taking the direction associated with that zone.

Each beacon only gives instructions for reaching the next beacon along the route to the vehicle's destination. For two vehicles starting from the same point for different destinations for which the routes are initially coincident, the beacons along the coincident section of route will each give both users the same instructions, because for those beacons both users are travelling to the same zone. Only for the beacon at the point of divergence are the two users' destinations in different zones, and therefore different instructions are given.

The beacons, programming may be modified from time to time by control signals from a central control station, in a way analogous to remotely controlled adjustable signposts, but in its interactions with the user equipment the beacon is autonomous, identifying which of its zones the user's desired destination is in, and transmitting the appropriate "turn" information to get it to the next beacon on the way. The beacon has no knowledge of the rest of the route.

Each beacon has a detailed map of a small local area (the boundaries of which are, in fact, the adjacent beacons), and if the destination is in this area the beacon gives full information of the route to the destination. The system can therefore provide a user with directions to a destination defined more precisely than the beacon spacing. However, at the beginning of a journey, a user cannot use the system until he encounters a beacon.

This proposed system allows instant updating of the guidance instructions from a central control, and simpler in-vehicle equipment, but requires vast capital expenditure in roadside beacons.

A problem encountered with both the proposed systems described above is that it is difficult for them to provide alternative routings in response to congestion, either current or future, without the risk of creating worse problems on the alternative routes. Although predictions of regularly occurring congestion peaks are relatively simple to programme into the guidance information, and, at least in the beacon system, real-time updates on road congestion can also be fed to the programming of the beacons, the control system does not have any information of vehicle movements from which to predict future congestion. In any case, if the system is in use by a significant fraction of the vehicles, the system will tend to produce congestion on the diversionary routes.

European Patent Application 0379198 discloses a position determination system which generates a displaying of the location of a mobile unit in relation to its surroundings. However, this provides no information on

how to carry out possibly quite a complex navigational problem in getting to where he wishes to be.

According to one aspect of the invention, there is provided a navigation information system for providing information to one or more mobile users dependent on their locations, the system comprising:

means for determining the location of a mobile unit requesting guidance information,
means for generating information for guidance of the user of the mobile unit according to the present location of the mobile unit,
and a communications system for transmitting the guidance information so generated to the mobile unit,

characterised in that the system is arranged to receive requests from the mobile unit relating to a specified destination, and to generate guidance information according to the specified destination,

whereby guidance information dependent both on the present location and the specified destination of the mobile unit can be transmitted to the mobile unit.

The mobile units provided for communicating with the fixed part, may each include means for transmitting to the fixed part a request for guidance information relating to a destination specified by the user of the mobile unit, and for receiving such guidance information transmitted from the fixed part.

According to another aspect there is provided a mobile unit for a navigation information system, comprising means for identifying the present position of the mobile unit, means for transmitting, over a communications link, information relating to the present location of the mobile unit, and guidance instruction means controllable by guidance instruction information received over the communications link, whereby guidance instructions related to the present location can be communicated to a user by means of the guidance instruction means, characterised in that the mobile unit has means for generating a request for guidance related to a specified destination, and for receiving guidance instruction means according to the present location and the specified destination.

According to a third aspect, there is provided a method of providing navigation guidance information to mobile units of a mobile radio system, the information being dependent on the locations of the mobile units, the method comprising the steps of:

- transmitting, from a mobile unit to the fixed part, a request for navigation guidance;
- determining the location of the mobile unit;
- generating guidance information on the basis of the location information and navigation data stored in the fixed part; and
- transmitting the guidance information from the fixed part to the mobile unit;

characterised in that the request for navigation information includes a specified destination, and the guidance information generated is select d according to the location information and the requested destination,

whereby guidance information relevant to the present location and specified destination of the mobile unit is transmitted to the mobile unit.

This invention has advantages over both the prior art systems discussed above. Considerable improvements can be made over the prior on-board navigation system proposals by putting the intelligence in the fixed part of the system. Firstly, there is no need to distribute maps or updates to subscribers because the data is held centrally. New roads can be added to the system at the instant they are opened. Total capital expenditure is minimised since all users share the same database. Moreover, the computing resources are used more efficiently, because an in-vehicle system spends most of its time inactive but a centralised system can be time-shared.

Moreover, in contrast to the prior art roadside beacon system, the invention can be implemented with little deployment of equipment in the field, thereby offering considerable economies in capital cost and maintenance, and allowing rapid installation and modification of the system to meet changing requirements.

Preferably the system includes means for determining the location of the mobile part in relation to a geographical overlay comprising a plurality of overlay areas, and means for transmitting information associated with an overlay area which includes the location of the mobile part, whereby a mobile part within that overlay area receives information associated with that overlay area. This allows information associated with a particular overlay area to be transmitted to any mobile units in that overlay area. The system may also comprise means for determining when a mobile part enters a predetermined overlay area, and means for transmitting a message, to a user other than the said mobile part, in response to the said mobile part entering the predetermined overlay area. For example, one overlay area may cover part of a road approaching a junction, and the message may be the appropriate instruction to the driver, as he approaches the junction, as to which way he should turn. Each individual overlay area therefore gives navigation instructions specific to that overlay area. The overlay areas may overlap, and may be of any size down to the practical minimum of the resolution of the location determination process. Large overlay areas are suitable for transmitting general information, whilst smaller areas can be used to target information to users in very precise locations, such as individual elements of a complicated road layout. The overlay areas may be delimited in two or three dimensions.

An advantage of this preferred arrangement over the fixed beacon systems is that the geographical over-

lay can be readily modified. Advantageously, the system includes means for storing a digital representation of the geographical overlay, and means for modifying the stored representation such that the configurations of the overlay areas may be selected to meet changing requirements. The overlay areas can be readily combined or subdivided, or their boundaries otherwise altered to meet changing circumstances without any modification to the hardware, simply by reconfiguring the geographical overlay defined in the central database. Moreover, unlike the prior art beacon system discussed above, there is no major cost in street furniture and supporting infrastructure, because existing cellular mobile communications systems may be used to transmit the instructions from a central database. If the driver enters an overlay area which is not on the route chosen by the system, an error message can be transmitted. Such messages may be transmitted to a user other than the mobile unit, for instance in order to monitor the whereabouts of valuable cargoes or of personnel working away from a base.

The geographical overlay may also be used to operate an access-control system, for example for site security or for levying tolls. In this arrangement, if a user enters an overlay area for which he does not have permission, an alert signal can be sent to a system controller, or to security staff on site who can intercept the interloper. Means may be provided (either in a fixed location or with the mobile user) to store a value associated with the mobile unit, and means arranged to modify the stored value in response to the messages transmitted in accordance with the location of the mobile unit, either to increment the value e.g. for subsequent billing, or to decrement the value e.g. in a prepaid stored-value device.

The fixed part may include means for storing map information or other data for use in providing information, herein referred to as guidance data, means for updating the stored guidance data, means for identifying mobile parts to which the updated data are applicable, and means for transmitting such data over the communications system to the mobile parts so identified. This allows information about changing traffic situations to be transmitted to all users who will be affected, without needing to broadcast the details to other users as would be the case with those prior art systems where updating is possible.

Although the information transmitted to the user is specific to the location, information about the user can be processed centrally. This allows short-term traffic predictions to be made. The guidance data transmitted to the mobile units can therefore be based on the position measurements of a plurality of the mobile parts. If the mobile parts are vehicles, these position measurements will identify the locations of roads, and an indication of their traffic density. As new roads are built or routes are diverted, traffic will move to the new routes. Measuring the position of the traffic will therefore result in the data being updated automatically. To reduce the volum of information transmitted, the fixed part may comprise means for transmitting to the mobile part an expected range of movement information and for receiving from the mobile part movement measurements outside the expected range, and the mobile part comprising means for measuring location and time to derive movement information, means to compare the movement information with the expected range received from a fixed part of the system, and means to automatically report to the fixed system movement measurements outside the expected range. In this way only exceptional traffic conditions are reported.

The fixed part may include means for generating and maintaining guidance data based on vehicle movement data derived from time information and position measurements of a plurality of the mobile parts and/or estimations of future locations of the mobile parts based on the guidance information previously transmitted to the mobile parts. Estimations of future locations of the mobile parts based on the guidance information previously transmitted to the mobile parts can be used to make estimates of future traffic situations.

The data stored in the data storage means may be updated, for example in response to changing traffic conditions, accidents, or highway maintenance. The system may include means for identifying the mobile units to which the updated data are applicable, and transmitting amended instructions over the communications system to said mobile parts. With knowledge of the journeys being planned by a large number of users, a better prediction of demand for particular roads (and hence of congestion on those roads) can be built up. This can be more stable than existing autonomous route-planning systems because the navigation system can take account of the journeys planned for other users.

Advantageously the invention can be implemented using a public cellular radio data service on an individual dial-up basis, providing a simple mechanism for billing and avoiding the need for a separate radio transmission system.

The means for determining the location of the mobile part may comprise means to interrogate a location-identifying means forming part of the mobile part operating for example by means of dead reckoning from a known start point, using an inertial navigation system or distance and direction measuring devices such as a compass and an odometer. Alternatively, the means for locating position may include means for identifying the location of the mobile part in relation to elements of the fixed part of the communications system. The location of the mobile part may be determined by a radio location system associated with the cellular radio system. In another alternative arrangement, a satellite navigation system may be used. In one preferred arrangement the fixed part has means to determine the approximate location of the mobile part, and the location identifying

means of the mobile part is arranged to respond to a location request from the interrogation means with a non-unique location signal which, in combination with the approximate location d t rmined by the fixed part, determines a unique location.

In a preferred arrangement, the fixed part and th mobile parts each have a satellite navigation system receiver, and the positions of the mobile parts as measured by the satellite navigation system are compared with those of the fixed part as measured by the satellite navigation system. The position of the fixed part can be known with great accuracy and provides a reference measurement which allows the position of the mobile part to be determined with greater accuracy than is possible by direct measurement using the satellite system alone.

Preferably the fixed part has one or more servers and means for allocating a server to a mobile part only when it requires service. In practice only a very small number of mobile units will require service at any given time, so this allows the computing resources of the fixed part to be used most efficiently, and the system can support many more mobile units in total than it has server capacity for. This is in contrast to the prior art system discussed above, in which each mobile unit requires a dedicated computer carried on board, which is only used for a fraction of the time. Moreover, all the servers can use a common road-use database, which can use the information on routes it has planned for mobile users to build a prediction of future road use status, such as likely congestion points, and build this into its guidance instruction process. For example the system can be arranged such that it does not direct more than a predetermined number of users to use a particular stretch of road at a particular time, and finds alternative routes for any users who would otherwise be directed along that road at that time. In this way the system can predict likely congestion points and take pre-emptive action.

The mobile part may include guidance instruction means controllable by instructions contained in the guidance information transmitted from the fixed part over the communications link, whereby guidance instructions can be communicated to the user by means of the guidance instruction means.

For some applications the vehicle may be controlled directly in response to the guidance information received over the communications link. However, for use on the public highway, it is preferable that the guidance information controls display means, which may be visual or audible or both, to indicate to a driver the direction to take.

The guidance instruction means may be programmable from the fixed part over the communications link, either automatically or by a human operator. The guidance instruction means may include a speech synthesiser, which may be located in the fixed part, transmitting voice messages to the user over the communications system, or may be located in the mobil unit and controlled by data messages from the fixed part. The former arrangement allows th mobile unit to be simplified, whilst the latter arrangement requires a smaller signalling load.

In the described embodiment the mobile part is in a vehicl , but it may be a hand-held device for guiding a pedestrian. In one form, the mobile part may be a conventional mobile cellular radio unit. This allows a basic service to be provide to a user without the need for any dedicated equipment.

Embodiments of the invention will now be described by way of example with reference to the drawings, in which:

Figure 1 shows a mobile part and a fixed part of a navigation information system according to an embodiment of the invention;

Figure 2 illustrates how the invention may be applied to a simple road layout;

Figure 3 illustrates the division of a territory into zones according to the instructions generated by the system;

Figure 4 illustrates an application of the invention to a more complex road layout;

Figures 5a and 5b illustrate the modification of an overlay in response to a change in traffic circumstances; an

Figure 6 illustrates a road network, showing overlay areas defined by the method of the invention in relation to a cellular radio network

According to the embodiment of Figure 1 the navigation system has a fixed part (comprising elements 12 to 19) and a number of mobile parts, of which one only is shown (comprising elements 1 to 10), interconnected by a cellular telephone network 11.

The mobile part comprises a mobile telephone 1 having an audio output 2, an audio input 3 and a radio antenna (transmitireceive) 4. The output 2 is connected to a decoder 5 to translate Dual-Tone Multi-Frequency (DTMF) signals received by the telephone 1 into data which is fed to an interface controller 6. The interface controller 6 also receives input from a GPS (Global Positioning System) satellite receiver 7. The interface controller transmits data to a DTMF encoder 8 which generates tones to be fed to the audio input of the mobile telephone. The audio output 2 and input 3 also include a loudspeaker 9 and microphone 10 respectively, to allow the telephone to be used for speech.

The fixed part comprises an interface with the cellular telephone network 11, connected through a DTMF decoder 12 and encoder 13 and a controller interface 14 to a computer 15. The computer 15 comprises a number of servers 16, one of which is allocated to each active mobile unit. The servers 16 have access to a geographical database 17, and a database of standard messages 18. The geographical databas 17 is updateable through updating input 19. The database 17 stores

the definitions of a number of ov rlay areas which together form a geographical overlay to the territory to be covered. Examples of overlays are illustrated in Figures 2, 4, 5a, 5b, and 6, to be described in detail later.

The mobile part obtains location information using the GPS receiver 7 and transmits this information, together with a request for directions to a specified destination, to the fixed part, where a server 16 relates the location information to its geographical database 17 and obtains message information associated with the location from the database 18, and transmits the information back to the mobile part.

The computer 15 may transmit messages in DTMF code, using the encoder 12, or it may generate voice messages which are transmitted through a voice output 20 to the cellular network 11.

DTMF signals are used to transmit the position of the vehicle to the computer 15 which can then offer information and guidance either to the vehicle or to a third party on demand.

In the following discussion, variations on the basic apparatus depicted in Figure 1 will also be described, in which certain elements are modified or replaced.

The system is operated as follows:-

At the start of a journey the driver requests service by activating a predialled control on the telephone 1. This service request is transmitted to the control interface 14 over the telephone network 11. The control interface 14 then allocates a free server 16 to answer the call and interrogate the vehicle GPS receiver 7 to determine its geographical position. The encoder 8 takes the latitude and longitude data and translates the numbers into DTMF tone-pairs, in a manner to be described in more detail below.

The cellular telephone couples this audio signal into its speech input path. This is easy to do with a hands-free vehicle-mounted cellular telephone since the microphone lead is accessible or alternatively, a small transducer can be mounted next to the microphone 10. A DTMF receiver 5 coupled to the loudspeaker 9 (again acoustically or electrically) decodes supervisory data (again in DTMF format) coming back from the server 16 to acknowledge the reception of location messages. If no acknowledgement is received by the DTMF unit then the data message is repeated.

The fixed end of the system comprises a DTMF decoder 12 and encoder 13 coupled to a serial data interface 14 of the server computer 15. This computer, on the one hand, can call the mobile part which will answer automatically and then provide its location using the DTMF signalling system or on the other hand can receive an unsolicited call, which would include the DTMF encoded identity of the mobile unit and would also provide the vehicle location using the DTMF interface 6.

The server 16 then captures the current position of tne user, and identifies the overlay area within which that position falls. The server also captures any permanent user-specific information such as the type of vehicle, which may be relevant for the route to be selected e.g. because of height or weight restrictions. The user may encode those requirements which are not permanent, but are specific to the present information request, (in particular his destination) by using the telephone keypad in response to voice prompts. However, in a preferred arrangement the call is presented to a human operator for the capture of this data. This allows the user to obtain assistance in identifying his desired destination to the system, and also allows the driver to speak his requirements, keeping his hands and eyes free for driving.

The operator then remotely programs the in-vehicle interface 6 with system data identifying the vehicle destination, for use in subsequent update processes, and instigates the generation of voice given directions and instructions to the driver by a speech generation subsystem of the computer server 16.

Position fixes may be made at regular intervals, e. g. every two minutes, or every kilometre. Alternatively the fixed part may request the mobile unit to send its next position fix after a specified interval or distance.

As the driver follows the route further instructions can automatically be sent as the driver enters each new overlay area and the driver can be alerted if the route has been left or if any new traffic problems have been detected that will affect the individual driver. The system is arranged such that when the system locates a mobile unit entering an overlay area having a message defined for it, for example the next turn instruction (or an error message if the mobile unit has gone off the selected route), that message is transmitted. The system may also be arranged to transmit messages to users other than the mobile unit in question, for example to monitor the progress of valuable cargoes.

At any time the driver can call the human operator if service requirements change or additional help is needed.

Because a central database is used all vehicle movements can be monitored. Traffic models can be used to optimise traffic flows and reduce journey times. The system can also ensure that it does not itself cause congestion, by limiting the number of vehicles it directs to use the same road at the same time. The control system can use the location data to calculate and record movement vectors from these vehicles.

Using the data collected by this method, it is possible for the central system to derive a digital map of valid routes. The following data could be derived automatically: valid travel lanes; permitted direction(s) of flow; allowable turns; average travel times; trends in travel times according to time of day and other factors.

The system would automatically update the map to show permanent changes (new road links, changes to one way systems etc.). Temporary lane closures from road works etc. would also be recorded. Manual updating of data would be necessary (for instance to alert the system to a new bypass opening) before the system ac-

quired the information from vehicle flow data, to ensure vehicles are routed over the new road initially. Any approximations in the preentered data would automatically be corrected by the system described here.

The system could be further enhanced to include any other information that may be relevant to travellers, by a combination of manual and automated data entry, e.g. location of bus stops, telephone boxes and other street furniture, and proximity to enterprises such as shops, banks or offices.

The variation of transit time trends according to time of day, for each link, could be used to derive a congestion prediction model, as the basis for route guidance. The system may monitor the progress of the mobile units along the routes selected for them, to identify any areas of traffic congestion etc, by comparing actual transit times between predetermined locations. This may be done by the fixed system monitoring the location updates of individual units, or it may be done by the mobile unit, in co-operation with the fixed unit. In this latter case, the fixed part transmits an expected range of transit times within which the mobile is expected to reach a predetermined location. If the mobile unit reaches the location outside this range, it reports the fact to the fixed part. By "reporting by exception" the data processing overhead can be reduced considerably.

However, these systems can become unstable if too many drivers have access to route guidance based on information about current or predicted congestion. To avoid these instabilities route plans are created and updated centrally and passed to individual vehicles. The impact of these vehicles using the suggested routes is then added to the prediction. As more vehicles use the system the prediction produced could become more accurate.

The routes derived can be passed to the vehicles (via a mobile data link, or possibly a short range communications link or other temporary access to a fixed telecommunications network - prior to departure). The vehicle would then operate autonomously, unless the road conditions varied significantly from those predicted.

If the central system detected a problem (from vehicle data or other sources), which had a severe impact on predictions, sufficient to cause a change to advice already given, then the central system could broadcast news of the problem, such that those vehicles affected could automatically call in via a mobile data communications link to receive a new route from its present location to its destination.

If a vehicle system encountered unexpected transit times along its programmed route it would send a report to the central system.

The data flowing though the system will therefore allow it to "learn" more of the road network's characteristic congestion behaviour, e.g. by use of neural net techniques, and to select routes for traffic which avoid using routes at times when they are likely to be congested. In addition, the system can generate digital road maps or other data automatically, based on the position measurements of vehicles using the roads.

A particular advantage of this system is th ability to predict unusual patterns of congestion from the route guidance information requested by the users. Because route guidance is generated centrally, the system can monitor the number of requests for destination information to a given location. By determining the predicted arrival times for each user (which will depend on their starting points, and the time the journey started), a build-up of traffic converging on a particular location at a particular future time (e.g. for a major sporting event) can be detected. Traffic for other destinations, which might have been routed by way of this location, can then be diverted to other routes.

The system described above uses an analogue telecommunications link, in which DTMF codes may be used. For an analogue cellular radio network DTMF is an ideal signalling medium when only short status messages are required to be transmitted. It can survive in the severe signal fading and noise of the mobile environment which frequently precludes the use of fast phase or frequency shift data modulation. Another advantage is the ability to co-exist with speech. For example a DTMF data burst containing vehicle position data could be sent at the start of a call and at intervals during the call. Other simple coded DTMF messages can also be conveyed to indicate emergencies, provide simple driver indications (e.g. illuminated arrows to turn left or right) or trigger synthetic speech generated by another sub-system in the vehicle.

The DTMF coding described above is suitable for an analogue system. In a digital cellular network digitised data can be transmitted over an associated packet data system such as the Short Message Service (SMS) of GSM (Global System for Mobile Communications), or the General Packet Radio Service (GPRS) proposed for GSM.

In the embodiment described above, the speech generation subsystem forms part of the server 16. Alternatively, it can be carried on board the vehicle. In this arrangement the subsystem has various stored speech commands which are controlled from the in-vehicle interface 6 in response to commands transmitted from the fixed part. This arrangement reduces the signalling traffic required over the radio link 11, but increases the complexity of the in-vehicle equipment.

The location-determination system will now be described in greater detail. GPS (Global Positioning System) satellite navigation receivers are now becoming very cheap and are available with a serial data output. These can provide latitude and longitude data to within a tenth of a second of arc (defining position to within 3 metres, which is sufficient to identify which carriageway of a dual carriageway road a user is on),

Satellite positioning systems such as the Global Positioning System (GPS) are prone to small systematic

errors, for example as a result of instabilities in the orbits of the satellites. The accuracy of the position measurement may be enhanced by a process known as "Differential GPS" in which a number of fixed reference points are used, whose positions are determined with great precision e.g. using surveying techniques. GPS is used to obtain a measure of the position of one or more of the fixed reference points. This measure is compared with the known, true location to generate a correction value which can be used to correct the position of the mobile unit as measured by GPS.

The position data received from the satellite positioning system may include some redundant data. If the system is only to operate within a limited area of the globe the most significant digits of the position data are redundant, and need not be transmitted from the mobile unit to the fixed part. For example, any point in Germany can be uniquely defined by the units digits of its latitude and of its longitude, as that country lies entirely between 45 and 55 degrees North, and between 5 and 15 degrees East. It is also possible to define any point in the United Kingdom in this way, although in that case a 10 degree offset in longitude has to be applied to avoid duplication of longitudes East and West of the zero meridian.

For larger territories e.g. a pan-European system, or one covering the USA, this simple method of data reduction is impractical. However, it is nevertheless possible to reduce the data requirements by dynamically defining the territory. After an initialisation step using the full location, the system selects as each new location the closest candidate to the previous one. For example, if the mobile unit was last reported at 99 degrees W and the units digit of the longitude is now 0, the user is taken to be at 100 degrees W rather than, for example, 90 degrees or 110 degrees.

If location updates take place sufficiently frequently that the user's position cannot have changed by more than half a degree, the units digit of degrees may also be dispensed with, and the location given only in minutes and seconds of arc. The more frequent the updates, the more digits can be dispensed with.

An alternative method of obtaining the coarse position location is interrogation of the cellular radio system's operating system to identify the cell in which the user is currently located. Cell sizes can be up to about 40km across (although they are often much smaller, so identifying the cell can identify the user's location to within 40km, which identifies latitude to better than half a degree. (1 degree of latitude = 111km). The separation of lines of longitude varies with the cosine of the latitude but even at the Arctic Circle (66 degrees North) a 40km resolution will identify longitude to the nearest whole degree (1 degree of longitude = 111 km (cos latitude) = approximately 45km at 66 degrees North).

By left-truncating the position data by omitting the degrees digits a basic position message would therefore consist of 10 decimal digits (minutes, seconds, and tenths of seconds). Altitude data giving altitude in metres would require a further four digits, since all points on the Earth's surface lie within a range of 10,000 metres, but this data can also be left-truncated, as it is unlikely that any multi-level road system would exceed 100 metres in height (or if it did, that a GPS system would work effectively for any receiver on the lower levels). This gives a total of twelve digits, which can be transmitted by DTMF in less than 2 seconds.

If the data is left-truncated as described above, the "coarse" data is added by the interface controller 14 by reference to the previous position or to the cellular radio operating system.

When the computer 15 receives a location message, it stores the location and then searches its database for an overlay area within which that position lies. The overlay areas are defined in the database by co-ordinates of latitude and longitude and have associated attributes which define messages which can be passed to mobile subscribers within the overlay area defined. In some instances height (altitude) information, also available using satellite positioning systems, may be used, for example to distinguish between levels in a multi-level highway intersection. When a DTMF location message has co-ordinates which fall inside an overlay area having an associated message, the message is then transmitted to the mobile part as a computer synthesised speech message, a DTMF coded message (to activate other subsystems) or as a high speed conventional data message.

If the mobile unit fell within the same overlay area at the previous location update, and the message associated with that overlay area is unchanged, the transmission of the message may be suspended.

The frequency at which location updates are requested by the system may be tailored to the size and nature of the current overlay area. For example, an intricate road layout may comprise a large number of small overlay areas, requiring frequent location updates to ensure that a user does not miss an instruction by passing through its associated area between two updates. However, a long stretch of road without junctions may be covered by a single overlay area, so less frequent updates are appropriate. The speed with which a vehicle is likely to be moving, which will differ between urban, rural, and motorway environments may also be used as a factor in determining when the next location update should be requested.

As suggested above, there may be circumstances when a satellite positioning system may be unusable, for example in tunnels or built-up areas where a line-of-sight view of the satellites may be impossible to obtain. Alternative arrangements for identifying and updating the mobile part's location which do not rely on a satellite receiver may be used, either on their own, or to interpolate between points where a satellite system can be used. In one variant, a navigation system based on dead-reckoning may be used. In such systems the user

id ntifies his initial location and the on-board system measures the system's movement e.g. by magnetic bearing measurements, distance counters, and inertial navigation means such as gyrocompasses and accelerometers. Such systems are self-contained, but require knowledge of the starting point. This may be obtained, for example from a satellite positioning system.

In another variant, a method of location may be used which relies on the propagation characteristics of the cellular radio system used for communication with the central control station. Examples of such systems are disclosed in German Patent specifications DE3825661 (Licentia Patent Verwaltungs) and DE 3516357 (Bosch), United States Patent 4210913 (Newhouse), European Patent specification EP0320913 (Nokia), and International Patent applications W092/13284 (Song) and WO 88/01061 (Ventana). By comparison of signal strength or other characteristics of several cellular base stations, a position fix can be determined. In this arrangement the location measurement may be made directly by the fixed system. This allows the mobile part of the system to be embodied by a conventional cellular telephone, with inputs being provided by speech, or by DTMF tones generated by the keypad, and instructions to the user being transmitted by voice commands.

Examples of the kind of navigation information which may be stored in the database 17 will now be discussed, with reference to Figures 2 to 6. Briefly, Figure 2 shows a junction J having four approach roads 21,22,23, 24; each having associated with it an overlay area 21a, 22a, 23a, 24a respectively. In this figure, and all other figures illustrating road layouts, the roads are shown arranged for lefthand running, as used for example in the UK, Japan, Australia etc. Figure 3 shows part of a road network surrounding the junction J, including towns A, B, C, and a motorway M. Each of the roads 21, 22, 23, 24 has an associated destination zone 21z etc. Figure 4 shows a complex grade-separated junction interlinking four roads N, S, E, W. The junction has superimposed on it an overlay having twelve overlay areas, Na, Ni, Nd, Sa, Si, Sd, Ea, Ei, Ed, Wa, Wi, Wd. Figure 5a shows a small region having a main road 33 and a side road 30. The main road 33 has two associated overlay areas 31, 32. Figure 5b is similar to Figure 5a, but an obstruction X is present on the main road 33, and the overlay area 32 has been subdivided into two overlay areas 32a, 32b, separated by the obstruction. Figure 6 shows an overlay comprising ten overlay areas 40 - 49 superimposed on a cellular radio coverage region comprising five cells 50 - 54.

In greater detail, the road junction J (Figure 2) has four approach roads 21, 22, 23, 24. On each road, at the approach to the junction, an overlay area (21a, 22a, 23a, 24a) is defined. These overlay areas have directional information associated with them, giving turn instructions or other navigational information. As shown in Figure 3, the entire territory covered by the navigation system can be divided into four zones 21z, 22z, 23z, 24z, each comprising the set of all locations for which the corresponding road 21, 22, 23, 24 should be taken from the junction J. In this particular example, road 24 leads directly into town A and is only used for local destinations (zone 24z), road 23 leads to town B (zone 23z), road 22 leads to town D (zone 22z) and road 21 leads to the motorway M, for all other destinations including town C and part of town A. These zones are defined differently for each junction: for example at junction J' different directions are appropriate for towns A and C, so these towns fall in different zones with respect to the overlay areas at that junction. The zones may even be defined differently for different overlay areas at the same junction. For example, if U-turns are not possible at the junction J, any traffic approaching the junction J by road 22 and requiring town D (perhaps as the result of a previous error, or a change of plan) must be routed by way of roads 21, M, and 25. Thus, for overlay area 22a there are only three zones: 24z, 23z and the combined 21z/22z, corresponding to the three permitted exits 21, 23, 24.

The zones may be re-defined according to circumstances. For example, when the motorway M is congested, the best route from junction J to town C may be by way of town B. In such circumstances, zones 21z and 23z are redefined so that town C now falls within zone 23z. It should be noted, however, that the total number of zones remains the number of exit routes from the relevant overlay area.

The overlay areas 21a, 22a, 23a, and 24a should be large enough to ensure that any vehicle approaching the junction gets at least one location update whilst within the relevant overlay area, and is thus sent the relevant turn instruction. As shown in Figure 2, these overlay areas are discrete, and may be considered equivalent to the coverage areas of the beacons of the prior art system discussed above. They may, however, be made contiguous, as shown in Figures 4, 5a, 5b and 6.

Figure 4 shows a more complex, grade-separated junction, in which there are twelve overlay areas. Each road N, E, S, W intersecting at the junction has a corresponding approach overlay area Na, Ea, Sa, Wa, (Wa shown shaded), and a depart overlay area Nd, Ed, Sd, Wd (Ed shown shaded). There are also four intermediate overlay areas Ni, Ei, Si, Wi (Si shown shaded). In the vicinity of the flyover F height (altitude) information obtainable from the GPS system can be used to determine which level, and therefore which overlay area, the user is currently in.

The approach and intermediate overlay areas each end at a decision point P1 to P8. In the database 17 each overlay area has direction information associated with it, providing instructions as to which fork to take at the associated decision point. For example, the direction information associated with zone Si instructs us rs for destinations served by road N to go straight on at point P1, and users for destinations served by roads E,

S, and W to turn left. It will be seen that traffic using the intersection will pass through one approach overlay area, one departure overlay area, and may also pass through one or more intermediate overlay areas. There may also be information associated with the departure overlay areas Nd, Sd, Ed, Wd, for example warning of hazards ahead. The departure overlay areas may be continuous with approach overlay areas for the next junction in each direction.

As a user approaches the junction on road S, a location update identifies the user equipment as being within overlay area Sa. If the co-ordinates of the user's destination are within the zone served by road W, the user is sent an instruction to turn left at point P2. If the user obeys this instruction, he will enter overlay area Wd and on the next location update he will be sent information relevant to that overlay area (if any).

If the co-ordinates of the user's destination are within the zone served by road N, the user in overlay area Sa is instead sent an instruction to continue straight on at point P2. If the user obeys this instruction, he will enter overlay area Si.

For a user in overlay area Si, if the co-ordinates of the user's destination are within the zone served by road N the user is sent an instruction to go straight on at point P1. On obeying this instruction, he will enter the overlay area Nd and on the next location update he will be sent information relevant to that overlay area (if any).

If the co-ordinates of the destination of a user in overlay area Si are in the zone served by roads E, S, or W, the user will be sent an instruction to turn left at point P1. On obeying this instruction, he will enter overlay area Wi.

Similar information is associated with the other overlay areas. By being given appropriate instructions as the user negotiates a succession of junctions (decision points), the user can be directed to any destination. It should be noted that all users who are to be directed to the same exit from the junction are given the same instruction, whatever their ultimate destination.

Figures 5a and 5b illustrate the reconfiguration of the overlay areas to meet changing circumstances. Initially (Figure 5a) an overlay area 31 is defined for the approach to a junction between a major road 33 and a side road 30, and a second overlay area 32 is defined for that part of the major road 33 beyond the junction. Information associated with the overlay area 31 includes turn information to instruct traffic for the zone served by the side road 30 to turn off. Information may also be associated with the overlay area 32.

In figure 5b the major road 33 has been blocked at a point X. In order to accommodate this, the overlay area 32 has been subdivided into two overlay areas 32a, 32b. The information (if any) associated with overlay area 32b is the same as that previously associated with overlay area 32. Traffic in overlay area 32a is given new information warning it of the hazard ahead. The information associated with the overlay area 31 is modified, so that all traffic is now instructed to turn off onto the side road 30. (Effectively this means that the destination zones associated with the overlay area 31 are merged into one)

Figure 6 shows how the overlay areas may be defined for a road network. In this example there is an overlay area 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 corresponding to each side of each section of road. Information appropriate to each direction of travel on each section is therefore available to users throughout the relevant section. Superimposed on this overlay there is a cellular radio network, five cells of which (50, 51, 52, 53, 54) are shown. The position of the user, as determined for example by a satellite positioning system, determines which overlay area is appropriate to the user. The information is transmitted to the service control centre by means of the cellular radio network. Handovers between cellular base stations occur in conventional manner at cell boundaries. These handovers are, however, unrelated to the boundaries between the overlay areas 40 - 49

Although the described embodiment relates to the provision of route guidance information, other locality-dependant information may be provided as well, or instead, such as information about local facilities, tourist attractions, weather forecasts, public transport information, etc. The term "guidance information", as used in this specification, embraces any such information.

Claims

1. A navigation information system for providing information to one or more mobile users dependent on their locations, the system comprising:

   means (14, 15, 17) for determining the location of a mobile unit requesting guidance information,

   means (18, 15, 14) for generating information for guidance of the user of the mobile unit according to the present location of the mobile unit,

   and a communications system (11, 13) for transmitting the guidance information so generated to the mobile unit,

   characterised in that the system has means (14, 16) for receiving requests from the mobile unit relating to a specified destination, and means (14, 16) for generating guidance information according to the specified destination,

   whereby guidance information dependent both on the present location and the specified destination of the mobile unit can be transmitted to the mobile unit.

2. A system as claimed in Claim 1, including means for determining the location of a mobile unit in relation to a geographical overlay comprising a plurality of overlay areas (30, 31, 32), and means for transmitting information associated with an overlay area (31) which includes the location of the mobile unit, whereby a mobile part within that overlay area (31) receives information associated with that overlay area.

3. A system as claimed in Claim 2, including means (17) for storing a digital representation of the geographical overlay, and means (19) for modifying the stored representation such that the configurations of the overlay areas may be selected to meet changing requirements.

4. A system according to Claim 2 or 3, including means (7, 16)for determining when a mobile unit enters a predetermined overlay area Si, and means for transmitting a message to the mobile unit in response to the mobile unit entering the predetermined overlay area (Si).

5. A system according to Claim 2, 3, or 4 including means for determining when a mobile unit enters a predetermined overlay area (Si) , and means for transmitting a message, to a user other than the said mobile unit, in response to the said mobile unit entering the predetermined overlay area.

6. A system according to claim 4 or 5, including means (16) to store a value associated with the mobile unit, and means arranged to modify the stored value in response to the message.

7. A system as claimed in any of claims 1 to 6, the means for determining the location of a mobile unit comprising means (16, 14, 13) to interrogate a location-identifying means (7) of a co-operating mobile unit to determine its position..

8. A system as claimed in any of claims 1 to 7, wherein the means for determining the location of the mobile unit comprises means for identifying the location of the mobile unit in relation to elements (50 to 54) of the fixed part of the communications system.

9. A system as claimed in claim 8, wherein the means for determining location comprises means to determine the approximate location of the mobile unit, means to receive a non-unique location signal from the mobile unit, and means to combine the approximate location information with the non-unique location information to determine a unique location.

10. A system as claimed in any of claims 1 to 9, including means for gen rating and maintaining guidance data based on vehicle movement data derived from time information and position measurements of a plurality of the mobile parts.

11. A system according to any of claims 1 to 10, having means (16, 14, 13) for transmitting to the mobile part an expected range of movement information, and means (12, 14, 16) for receiving from the mobile part movement measurements outside the expected range.

12. A system according to any of claims 1 to 11, including means for storing guidance data, means for updating the stored guidance data, means for identifying mobile units to which the updated data are applicable, and means for transmitting such data over the communications system to the mobile units so identified.

13. A system as claimed in any of claims 1 to 12, having input means operable by a human operator to input guidance instruction requests.

14. A system as claimed in any preceding claim, comprising a dual tone multi-frequency (DTMF) encoder (13) for converting data to DTMF format for transmission to the mobile units

15. A system as claimed in any preceding claim, comprising a dual tone multi-frequency (DTMF) decoder (12) for receiving data in DTMF format from the mobile units.

16. A system as claimed in claim 15, wherein the data received in DTMF format relates to the position of the mobile unit.

17. A system as claimed in any preceding claim, having means (11) for locating the position of the mobile part by radio location

18. A navigation information system for providing information to one or more mobile users dependent on the locations of the mobile users, the system comprising a fixed part, being a system (11-20) according to any preceding claim, in combination with one or more mobile units (1-10) for communicating with the fixed part, each mobile unit including means (6,8,10,1) for transmitting to the fixed part a request for guidance information relating to a destination specified by the user of the mobile unit, and means (1,9,5,6) for receiving such guidance information from the fixed part.

19. A system as claimed in claim 18, wherein the mobile part has means for identifying its position by dead reckoning

20. A system as claimed in claim 18 or 19 when dependant on claim 11, the mobile part comprising means for measuring location and time to derive movement information, means to compare the movement information with the expected range received from a fixed part of the system, and means to automatically report to the fixed system movement measurements outside the expected range.

21. A system according to claim 18 19 or 20, wherein the mobile part includes guidance instruction means controllable by instructions contained in the guidance information transmitted from the fixed part over the communications link, whereby guidance instructions can be communicated to the user by means of the guidance instruction means.

22. A system as claimed in claim 18 19 20 or 21 when dependant on claim 15, wherein the mobile part comprises a dual tone multi-frequency (DTMF) encoder (8) for converting data to DTMF format for transmission to the fixed part.

23. A system as claimed in claim 22, wherein the mobile unit has means (6) for converting data relating to its position into DTMF format, and the fixed part has means (12,14) for receiving and processing said data.

24. A system as claimed in any of claims 18 to 23 when dependant on claim 14, comprising a dual tone multi-frequency (DTMF) decoder (5) for receiving data in DTMF format from the fixed part.

25. A mobile unit for a navigation information system, comprising means (7) for identifying the present position of the mobile unit, means (8, 10, 1) for transmitting, over a communications link (11), information relating to the present location of the mobile unit, and guidance instruction means (6) controllable by guidance instruction information received over the communications link, whereby guidance instructions related to the present location can be communicated to a user by means of the guidance instruction means,
characterised in that the mobile unit has means (6) for generating a request for guidance related to a specified destination, and for receiving guidance instruction means according to the present location and the specified destination.

26. A mobile unit according to claim 25, comprising means (7) for measuring the location of the mobile unit, and time measurement means, to derive movement information, means to compare the movement information with an expected range received from a fixed part of the system, and means to automatically report to the fixed system movement measurements outside the expected range.

27. A mobile unit according to claim 25 or 26, comprising a dual tone multi-frequency (DTMF) ncoder (8) for converting data to DTMF signals for transmission.

28. A mobile unit as claimed in claim 27, having means (6) for converting data relating to its position into DTMF format.

29. A mobile unit as claimed in claim 25, 26, 27 or 28, comprising a dual tone multi-frequency (DTMF) decoder (5) for receiving data in DTMF format.

30. A method of providing navigation guidance information to mobile units of a mobile radio system, the information being dependent on the locations of the mobile units, the method comprising the steps of:

- transmitting, from a mobile unit (1) to a fixed part (11-20), a request for navigation guidance;
- determining the location of the mobile unit;
- generating guidance information on the basis of the location information and navigation data stored in the fixed part; and
- transmitting the guidance information from the fixed part to the mobile unit;

characterised in that the request for navigation information includes a specified destination, and the guidance information generated is selected according to the location information and the requested destination,
whereby guidance information relevant to the present location and specified destination of the mobile unit is transmitted to the mobile unit.

31. A method as claimed in Claim 30, wherein the location of the mobile unit is determined in relation to a geographical overlay (40-49) comprising a plurality of overlay areas, generating information associated with an overlay area which includes the location of the mobile part, and transmitting the information associated with the relevant overlay area to the mobile part, whereby a mobile part within that overlay area receives information associated with that overlay area.

32. A method as claimed in claim 31, including the step of storing a digital representation of the geographical overlay, and modifying the stored representation such that the configurations of the overlay areas may be selected to meet changing requirements.

33. A method according to Claim 31 or 32, comprising the further steps of determining when a mobile unit enters a predetermined overlay area (Si), and trans-

mitting a message to the mobile unit in response to the mobile unit entering the predetermined overlay area.

34. A method according to Claim 31, 32, or 33 including the further steps of determining when a mobile unit enters a predetermined overlay area, and transmitting a message to a user other than the said mobile unit in response to the mobile unit entering the predetermined overlay area.

35. A method according to claim 33 or 34 including the further step of modifying a stored value associated with the mobile unit in response to the message.

36. A method as claimed in any of claims 30 to 35, wherein the position of the mobile unit is identified by a radio location method.

37. A method as claimed in Claim 36, wherein the position of the mobile unit is determined by means of a satellite navigation system and/or by identifying the location of the mobile part in relation to elements of the fixed part of the communications system.

38. A method according to any of Claims 30 to 37, wherein the fixed part interrogates the mobile unit to identify its location.

39. A method as claimed in claim 38 wherein the fixed part determines the approximate location of the mobile part, and wherein the mobile part responds to a location request from the interrogation means with a non-unique location signal which, in combination with the approximate location determined by the fixed part, determines a unique location.

40. A method as claimed in any of claims 30 to 39, wherein the mobile unit identifies its position by dead reckoning.

41. A method according to any of Claims 30 to 40, including the steps of generating and maintaining data based on vehicle movement data derived from time information and position measurements of a plurality of the mobile parts and/or estimations of future locations of the mobile parts based on the guidance information previously transmitted to the mobile parts.

42. A method according to any of claims 30 to 41 wherein the fixed part transmits to the mobile part an expected range of movement information, and the mobile part measures location and time to derive movement information, compares the movement information with the expected range received from the fixed part of the system, and reports to the fixed system movement measurements outside the expected range.

43. A method as claimed in any of Claims 30 to 42 including the further steps of the updating the stored data, identifying th mobile units to which the updated data are applicable, and transmitting such data over the communications system to said applicable mobile parts.

44. A method as claimed in any of claims 30 to 43, wherein the guidance information transmitted to the mobile unit controls guidance instruction means (9) forming part of the mobile unit, whereby guidance instructions can be communicated to the user of the mobile unit.

45. A method as claimed in any of claims 30 to 44, wherein at least part of the communication between the mobile and fixed parts is by means of dual tone multi-frequency (DTMF) signals.

46. A system as claimed in claim 45, wherein the information relating to the position of the mobile unit is transmitted in DTMF format.

Patentansprüche

1. Navigationsinformationssystem zur Bereitstellung von Informationen für einen oder mehrere mobile Benutzer in Abhängigkeit von ihren Orten, wobei das System enthält:

eine Einrichtung (14, 15, 17) zum Bestimmen des Ortes einer mobilen Einheit, die Führungsinformationen anfordert,
eine Einrichtung (18, 15, 14) zum Erzeugen von Informationen zum Führen des Benutzers der mobilen Einheit entsprechend dem momentanen Ort der mobilen Einheit,
und ein Kommunikationssystem (11, 13) zum Senden der so erzeugten Führungsinformationen an die mobile Einheit,

dadurch gekennzeichnet, daß das System eine Einrichtung (14, 16) zum Empfangen von Anforderungen von der mobilen Einheit bezüglich eines spezifizierten Ziels sowie eine Einrichtung (14, 16) zum Erzeugen von Führungsinformationen entsprechend dem spezifizierten Ziel enthält,

wobei an die mobile Einheit Führungsinformationen, die sowohl vom momentanen Ort als auch vom spezifizierten Ziel der mobilen Einheit abhängen, gesendet werden können.

2. System nach Anspruch 1, mit einer Einrichtung zum Bestimmen des Ortes einer mobilen Einheit in be-

zug auf eine geographische Überlagerung, die mehrere Überlagerungsbereiche (30, 31, 32) enthält, und einer Einrichtung zum Senden von Informationen, die einem den Ort der mobilen Einheit enthaltenden Überlagerungsbereich (31) zugeordnet ist, wobei ein mobiles Teil in diesem Überlagerungsbereich (31) dem Überlagerungsbereich zugeordnete Informationen empfängt.

3. System nach Anspruch 2, mit einer Einrichtung (17) zum Speichern einer digitalen Darstellung der geographischen Überlagerung und einer Einrichtung (19) zum Modifizieren der gespeicherten Darstellung in der Weise, daß die Konfigurationen der Überlagerungsbereiche so gewählt werden können, daß sich ändernde Anforderungen erfüllt werden.

4. System nach Anspruch 2 oder 3, mit einer Einrichtung (7, 16) zum Bestimmen, wann eine mobile Einheit in einen vorgegebenen Überlagerungsbereich Si eintritt, und einer Einrichtung zum Senden einer Nachricht an die mobile Einheit als Antwort auf das Eintreten der mobilen Einheit in den vorgegebenen Überlagerungsbereich (Si).

5. System nach Anspruch 2, 3 oder 4, mit einer Einrichtung zum Bestimmen, wann eine mobile Einheit in einen vorgegebenen Überlagerungsbereich (Si) eintritt, und einer Einrichtung zum Senden einer Nachricht an einen von der mobilen Einheit verschiedenen Benutzer als Antwort auf das Eintreten der mobilen Einheit in den vorgegebenen Überlagerungsbereich.

6. System nach Anspruch 4 oder 5, mit einer Einrichtung (16) zum Speichern eines der mobilen Einheit zugeordneten Werts und einer Einrichtung, die so beschaffen ist, daß sie den gespeicherten Wert als Antwort auf die Nachricht modifiziert.

7. System nach irgendeinem der Ansprüche 1 bis 6, wobei die Einrichtung zur Bestimmung des Ortes einer mobilen Einheit eine Einrichtung (16, 14, 13) enthält, die eine Ortidentifizierungseinrichtung (7) einer mit ihr zusammenarbeitenden mobilen Einheit abfragt, um deren Position zu bestimmen.

8. System nach irgendeinem der Ansprüche 1 bis 7, wobei die Einrichtung zum Bestimmen des Ortes der mobilen Einheit eine Einrichtung zur Identifizieren des Ortes der mobilen Einheit in bezug auf Elemente (50 bis 54) des festen Teils des Kommunikationssystems enthält.

9. System nach Anspruch 8, wobei die Einrichtung zum Bestimmen des Ortes eine Einrichtung zum Bestimmen des ungefähren Ortes der mobilen Einheit, eine Einrichtung zum Empfangen eines nicht eindeutigen Ortssignals von der mobilen Einheit sowie eine Einrichtung enthält, die die Informationen bezüglich des ungefähren Ortes mit den Informationen des nicht eindeutigen Ortes kombiniert, um einen eindeutigen Ort zu bestimmen.

10. System nach irgendeinem der Ansprüche 1 bis 9, mit einer Einrichtung zum Erzeugen und Beibehalten von Führungsdaten auf der Grundlage von Fahrzeugbewegungsdaten, die aus Zeitinformationen und Positionsmessungen mehrerer der mobilen Teile abgeleitet werden.

11. System nach irgendeinem der Ansprüche 1 bis 10, mit einer Einrichtung (16, 14, 13) zum Senden von Informationen bezüglich eines erwarteten Bewegungsbereichs an den mobilen Teil und einer Einrichtung (12, 14, 16) zum Empfangen von Bewegungsmessungen des mobilen Teils außerhalb des erwarteten Bereichs.

12. System nach irgendeinem der Ansprüche 1 bis 11, mit einer Einrichtung zum Speichern von Führungsdaten, einer Einrichtung zum Aktualisieren der gespeicherten Führungsdaten, einer Einrichtung zum Identifizieren mobiler Einheiten, auf die die aktualisierten Daten anwendbar sind, und einer Einrichtung zum Senden solcher Daten an die so identifizierten mobilen Einheiten über das Kommunikationssystem.

13. System nach irgendeinem der Ansprüche 1 bis 12, mit einer Eingabeeinrichtung, die von einer menschlichen Bedienungsperson bedienbar ist, um Führungsbefehlanforderungen einzugeben.

14. System nach irgendeinem vorangehenden Anspruch, mit einem Mehrfrequenzwahl-Codierer (DTMF-Codierer) (13), zum Umsetzen von Daten in das DTMF-Format für ihre Übertragung an die mobilen Einheiten.

15. System nach irgendeinem vorangehenden Anspruch, mit einem Mehrfrequenzwahl-Decodierer (DTMF-Decodierer) (12) zum Empfangen von Daten in DTMF-Format von den mobilen Einheiten.

16. System nach Anspruch 15, wobei die im DTMF-Format empfangenen Daten auf die Position der mobilen Einheit bezogen sind.

17. System nach irgendeinem vorangehenden Anspruch, mit einer Einrichtung (11) zum Lokalisieren der Position des beweglichen Teils durch Funkortung.

18. Navigationsinformationssystem für die Bereitstel-

lung von Informationen für einen oder mehrere mobile Benutzer in Abhängigkeit von den Orten der mobilen Benutzer, wobei das System einen festen Teil, der ein System (11-20) nach irg ndeinem vorangehenden Anspruch ist, in Kombination mit einer oder mehreren mobilen Einheiten (1-10), die mit dem festen Teil kommunizieren, enthält, wobei jede mobile Einheit eine Einrichtung (6, 8, 10, 1) zum Senden einer Anforderung von Führungsinformationen bezüglich eines vom Benutzer der mobilen Einheit spezifizierten Ziels an den festen Teil sowie eine Einrichtung (1, 9, 5, 6) zum Empfangen der Führungsinformationen vom festen Teil enthält.

19. System nach Anspruch 18, wobei der bewegliche Teil eine Einrichtung zum Identifizieren seiner Position durch Besteckrechnen besitzt.

20. System nach Anspruch 18 oder 19 in Verbindung mit Anspruch 11, wobei der bewegliche Teil eine Einrichtung zum Messen des Ortes und der Zeit, um daraus Bewegungsinformationen abzuleiten, eine Einrichtung zum Vergleichen der Bewegungsinformationen mit dem von einem festen Teil des Systems empfangenen erwarteten Bereich sowie ein Einrichtung zum automatischen Melden von Bewegungsmessungen außerhalb des erwarteten Bereichs an das feste System enthält.

21. System nach Anspruch 18, 19 oder 20, wobei der bewegliche Teil eine Führungsbefehlseinrichtung enthält, die durch Befehle steuerbar ist, die in den vom festen Teil über die Kommunikationsverbindung gesendeten Führungsinformationen enthalten sind, wobei Führungsbefehle an den Benutzer mittels der Führungsbefehlseinrichtung übermittelt werden können.

22. System nach Anspruch 18, 19, 20 oder 21 in Verbindung mit Anspruch 15, wobei der bewegliche Teil einen Mehrfrequenzwahl-Codierer (DTMF-Codierer) (8) zum Umsetzen von Daten in das DTMF-Format für ihre Übertragung an den festen Teil enthält.

23. System nach Anspruch 22, wobei die mobile Einheit eine Einrichtung (6) zum Umsetzen von auf ihre Position bezogenen Daten in das DTMF-Format enthält und der feste Teil eine Einrichtung (12, 14) zum Empfangen und Verarbeiten der Daten enthält.

24. System nach irgendeinem der Ansprüche 18 bis 23 in Verbindung mit Anspruch 14, mit einem Mehrfrequenzwahl-Decodierer (DTMF-Decodierer) (5) zum Empfangen von Daten im DTMF-Format vom festen Teil.

25. Mobile Einheit für ein Navigationsinformationssystem, mit einer Einrichtung (7) zum Identifizieren der momentanen Position der mobilen Einheit, einer Einrichtung (8, 10, 1) zum Senden von Informationen bezüglich des momentanen Ortes der mobilen Einheit über eine Kommunikationsverbindung (11) sowi einer Führungsbefehlseinrichtung (6), die durch über die Kommunikationsverbindung empfangene Führungsbefehlsinformationen steuerbar ist, wobei die auf den momentanen Ort bezogenen Führungsbefehle an einen Benutzer mittels der Führungsbefehlseinrichtung übermittelt werden können,
dadurch gekennzeichnet, daß die mobile Einheit eine Einrichtung (6) zum Erzeugen einer Anforderung für eine auf ein spezifiziertes Ziel bezogene Führung und zum Empfangen von Führungsbefehlen gemäß dem momentanen Ort und dem spezifizierten Ziel besitzt.

26. Mobile Einheit nach Anspruch 25, mit einer Einrichtung (7) zum Messen des Ortes der beweglichen Einheit und einer Zeitmeßeinrichtung, um Bewegungsinformationen abzuleiten, einer Einrichtung zum Vergleichen der Bewegungsinformationen mit einem von einem festen Teil des Systems empfangenen erwarteten Bereich und einer Einrichtung zum automatischen Melden von Bewegungsmessungen außerhalb des erwarteten Bereichs an das feste System.

27. Mobile Einheit nach Anspruch 25 oder 26, mit einem Mehrfrequenzwahl-Codierer (DTMF-Codierer) (8) zum Umsetzen von zu sendenden Daten in DTMF-Signale.

28. Mobile Einheit nach Anspruch 27, mit einer Einrichtung (6) zum Umsetzen von auf ihre Position bezogenen Daten in das DTMF-Format.

29. Mobile Einheit nach Anspruch 25, 26, 27 oder 28, mit einem Mehrfrequenzwahl-Decodierer (DTMF-Decodierer) (5) zum Empfangen von Daten im DTMF-Format.

30. Verfahren zum Bereitstellen von Navigationsführungsinformationen für mobile Einheiten eines Mobilfunksystems, wobei die Informationen von den Orten der mobilen Einheiten abhängen, wobei das Verfahren die folgenden Schritte enthält:

- Senden einer Anforderung für eine Navigationsführung von einer mobilen Einheit (1) an einen festen Teil (11-20);
- Bestimmen des Ortes der mobilen Einheit;
- Erzeugen von Führungsinformationen auf der Grundlage der Ortsinformationen der im festen T il gespeicherten Navigationsdaten; und
- Senden der Führungsinformationen vom festen Teil an die mobile Einheit;

dadurch gekennzeichnet, daß die Anforderung für Navigationsinformationen ein spezifiziertes Ziel enthält und die erzeugten Führungsinformationen entsprechend den Ortsinformationen und dem angeforderten Ziel gewählt werden,

wobei Führungsinformationen, die für den momentanen Ort und für das spezifizierte Ziel der mobilen Einheit von Bedeutung sind, an die mobile Einheit gesendet werden.

31. Verfahren nach Anspruch 30, bei dem der Ort der mobilen Einheit in bezug auf eine geographische Überlagerung (40-49), die mehrere Überlagerungsbereiche enthält, bestimmt wird, Informationen, die dem Überlagerungsbereich zugeordnet sind, der den Ort des mobilen Teils enthält, erzeugt werden und die dem relevanten Überlagerungsbereich zugeordneten Informationen an den mobilen Teil gesendet werden, wobei ein mobiler Teil innerhalb des Überlagerungsbereichs die dem Überlagerungsbereich zugeordneten Informationen empfängt.

32. Verfahren nach Anspruch 31, enthaltend den Schritt des Speicherns einer digitalen Darstellung der geographischen Überlagerung und des Modifizierens der gespeicherten Darstellung in der Weise, daß die Konfigurationen der Überlagerungsbereiche so gewählt werden können, daß sich ändernde Anforderungen erfüllt werden.

33. Verfahren nach Anspruch 31 oder 32, mit den weiteren Schritten des Bestimmens, wann eine mobile Einheit in einen vorgegebenen Überlagerungsbereich (Si) eintritt, und des Sendens einer Nachricht an die mobile Einheit als Antwort auf das Eintreten der mobilen Einheit in den vorgegebenen Überlagerungsbereich.

34. Verfahren nach Anspruch 31, 32 oder 33, mit den weiteren Schritten des Bestimmens, wann eine mobile Einheit in einen vorgegebenen Überlagerungsbereich eintritt, und des Sendens einer Nachricht an einen von der mobilen Einheit verschiedenen Benutzer als Antwort auf das Eintreten der mobilen Einheit in den vorgegebenen Überlagerungsbereich.

35. Verfahren nach Anspruch 33 oder 34, mit dem weiteren Schritt des Modifizierens eines der mobilen Einheit zugeordneten gespeicherten Werts als Antwort auf die Nachricht.

36. Verfahren nach irgendeinem der Ansprüche 30 bis 35, bei dem die Position der mobilen Einheit durch ein Funkortungsverfahren identifiziert wird.

37. Verfahren nach Anspruch 36, bei dem die Position der mobilen Einheit mittels eines Satellitennavigationssystems und/oder durch Identifizieren des Ortes des mobilen Teils in bezug auf Elemente des festen Teils des Kommunikationssystems bestimmt wird.

38. Verfahren nach irgendeinem der Ansprüche 30 bis 37, bei dem der feste Teil die mobile Einheit abfragt, um deren Ort zu identifizieren.

39. Verfahren nach Anspruch 38, bei dem der feste Teil den ungefähren Ort des mobilen Teils bestimmt und bei dem der mobile Teil auf eine Ortungsanforderung von der Abfrageeinrichtung mit einem nicht eindeutigen Ortungssignal antwortet, das in Kombination mit dem durch den festen Teil bestimmten ungefähren Ort einen eindeutigen Ort bestimmt.

40. Verfahren nach irgendeinem der Ansprüche 30 bis 39, bei dem die mobile Einheit ihre Position durch Besteckrechnen identifiziert.

41. Verfahren nach irgendeinem der Ansprüche 30 bis 40, enthaltend die Schritte des Erzeugens und Beibehaltens von Daten, die auf Fahrzeugbewegungsdaten basieren, die aus Zeitinformationen und Positionsmessungen von mehreren der mobilen Teile abgeleitet werden, und/oder von Schätzungen künftiger Orte der mobilen Teile, die auf den vorher an die mobilen Teile gesendeten Führungsinformationen basieren.

42. Verfahren nach irgendeinem der Ansprüche 30 bis 41, bei dem der feste Teil an den mobilen Teil einen erwarteten Bereich von Bewegungsinformationen sendet und der mobile Teil den Ort und die Zeit mißt, um Bewegungsinformationen abzuleiten, die Bewegungsinformationen mit dem vom festen Teil des Systems empfangenen erwarteten Bereich vergleicht und dem festen System Bewegungsmessungen außerhalb des erwarteten Bereichs meldet.

43. Verfahren nach irgendeinem der Ansprüche 30 bis 42, enthaltend die weiteren Schritte des Aktualisierens der gespeicherten Daten, des Identifizierens der mobilen Einheiten, auf die die aktualisierten Daten anwendbar sind, und des Sendens derartiger Daten an die in Frage kommenden mobilen Teile über das Kommunikationssystem.

44. Verfahren nach irgendeinem der Ansprüche 30 bis 43, bei dem die an die mobile Einheit gesendeten Führungsinformationen eine Führungsbefehlseinrichtung (9) steuern, die einen Teil der mobilen Einheit bildet, wobei die Führungsbefehle an den Benutzer der mobilen Einheit übermittelt werden können.

45. Verfahren nach irgendeinem der Ansprüche 30 bis

44, bei dem wenigstens ein Teil der Kommunikation zwischen dem mobilen Teil und dem festen Teil mittels Mehrfrequenzwahl-Signalen (DTMF-Signalen) erfolgt.

46. System nach Anspruch 45, bei dem die auf die Position der mobilen Einheit bezogenen Informationen im DTMF-Format gesendet werden.

Revendications

1. Système d'informations de navigation destiné à fournir des informations à un ou plusieurs utilisateurs d'unités mobiles suivant leurs localisations, le système comprenant :

un moyen (14, 15, 17) destiné à déterminer la localisation d'une unité mobile demandant des informations de guidage,
un moyen (18, 15, 14) destiné à générer des informations pour le guidage de l'utilisateur de l'unité mobile conformément à la localisation actuelle de l'unité mobile,
et un système de communications (11, 13) destiné à transmettre les informations de guidage ainsi générées vers l'unité mobile,

caractérisé en ce que le système comporte un moyen (14, 16) destiné à recevoir des demandes provenant de l'unité mobile se rapportant à une destination spécifiée, et un moyen (14, 16) destiné à générer des informations de guidage conformément à la destination spécifiée,

d'où il résulte que des informations de guidage, dépendant à la fois de la localisation actuelle et de la destination spécifiée de l'unité mobile, peuvent être transmises à l'unité mobile.

2. Système selon la revendication 1, comprenant un moyen destiné à déterminer la localisation d'une unité mobile en relation avec une couverture géographique comprenant une pluralité de zones de couverture (30, 31, 32), et un moyen destiné à transmettre des informations associées à une zone de couverture (31) qui comprend la localisation de l'unité mobile, d'où il résulte qu'une partie mobile à l'intérieur de cette zone de couverture (31) reçoit des informations associées à cette zone de couverture.

3. Système selon la revendication 2, comprenant un moyen (17) destiné à mémoriser une représentation numérique de la couverture géographique, et un moyen (19) destiné à modifier la représentation mémorisée d sorte que les configurations des zones de couverture puissent être choisies pour satisfaire des exigences variables.

4. Syst`me selon la revendication 2 ou 3, comprenant un moyen (7, 16) destiné à déterminer quand une unité mobile entre dans une zone de couverture prédéterminée Si, et un moyen destiné à transmettre un message à l'unité mobile en réponse au fait que l'unité mobile entre dans la zone de couverture prédéterminée (Si).

5. Système selon la revendication 2, 3 ou 4, comprenant un moyen destiné à déterminer quand une unité mobile entre dans une zone de couverture prédéterminée (Si), et un moyen destiné à transmettre un message, à un utilisateur autre que ladite unité mobile, en réponse au fait que ladite unité mobile entre dans la zone de couverture prédéterminée.

6. Système selon la revendication 4 ou 5, comprenant un moyen (16) destiné à mémoriser une valeur associée à l'unité mobile, et un moyen agencé pour modifier la valeur mémorisée en réponse au message.

7. Système selon l'une quelconque des revendications 1 à 6, le moyen destiné à déterminer la localisation d'une unité mobile comprenant un moyen (16, 14, 13) pour interroger un moyen d'identification de localisation (7) d'une unité mobile coopérante afin de déterminer sa position.

8. Système selon l'une quelconque des revendications 1 à 7, dans lequel le moyen destiné à déterminer la localisation de l'unité mobile comprend un moyen destiné à identifier la localisation de l'unité mobile en relation avec des éléments (50 à 54) de la partie fixe du système de communications.

9. Système selon la revendication 8, dans lequel le moyen destiné à déterminer une localisation comprend un moyen destiné à déterminer la localisation approchée de l'unité mobile, un moyen destiné à recevoir un signal de localisation non unique depuis l'unité mobile, et un moyen destiné à combiner les informations de localisation approchée aux informations de localisation non unique afin de déterminer une localisation unique.

10. Système selon l'une quelconque des revendications 1 à 9, comprenant un moyen destiné à générer et à entretenir des données de guidage sur la base des données de mouvement de véhicule obtenues à partir des informations d'heure et des mesures de position d'une pluralité des parties mobiles.

11. Système selon l'une quelconque des rev ndications 1 à 10, comportant un moyen (16, 14, 13) destiné à transmettre à la partie mobile une plage pré-

vue d'informations de mouvement, et un moyen (12, 14, 16) destiné à recevoir de la partie mobile des mesures de mouvement à l'extérieur de la plage prévue.

12. Système selon l'une quelconque des revendications 1 à 11, comprenant un moyen destiné à mémoriser des données de guidage, un moyen destiné à mettre à jour les données de guidage mémorisées, un moyen destiné à identifier des unités mobiles auxquelles les données mises à jour sont applicables, et un moyen destiné à transmettre de telles données sur le système de communications vers les unités mobiles ainsi identifiées.

13. Système selon l'une quelconque des revendications 1 à 12, comportant un moyen d'entrée pouvant être mis en oeuvre par un opérateur humain pour recevoir en entrée des demandes d'instructions de guidage.

14. Système selon l'une quelconque des revendications précédentes, comprenant un codeur multi-fréquence à double tonalité (DTMF) (13) destiné à convertir des données sous un format de code DTMF pour une transmission vers les unités mobiles.

15. Système selon l'une quelconque des revendications précédentes, comprenant un décodeur multi-fréquence à double tonalité (DTMF) (12) destiné à recevoir des données sous un format de code DTMF depuis les unités mobiles.

16. Système selon la revendication 15, dans lequel les données reçues sous un format de code DTMF se rapportent à la position de l'unité mobile.

17. Système l'une quelconque des revendications précédentes, comportant un moyen (11) destiné à localiser la position de la partie mobile par une localisation radio.

18. Système d'informations de navigation destiné à fournir des informations à un ou plusieurs utilisateurs d'unités mobiles suivant les localisations des utilisateurs d'unités mobiles, le système comprenant une partie fixe, qui est un système (11 à 20) selon l'une quelconque des revendications précédentes, en combinaison avec une ou plusieurs unités mobiles (1 à 10) destinées à communiquer avec la partie fixe, chaque unité mobile comprenant un moyen (6, 8, 10, 1) destiné à transmettre à la partie fixe une demande d'informations de guidage se rapportant à une destination spécifiée par l'utilisateur de l'unité mobile, et un moyen (1, 9, 5, 6) destiné à recevoir de telles informations de guidage de la partie fixe.

19. Système selon la revendication 18, dans lequel la partie mobil comporte un moyen destiné à identifier sa position par navigation à l'estime.

20. Système selon la revendication 18 ou 19, lorsqu'elle dépend de la revendication 11, la partie mobile comprenant un moyen destiné à mesurer la localisation et l'heure afin d'obtenir des informations de mouvement, un moyen destiné à comparer les informations de mouvement à la plage prévue reçue d'une partie fixe du système, et un moyen destiné à signaler automatiquement au système fixe les mesures de mouvement à l'extérieur de la plage prévue.

21. Système selon la revendication 18, 19 ou 20, dans lequel la partie mobile comprend un moyen d'instructions de guidage qui peut être commandé par des instructions contenues dans les informations de guidage transmises à partir de la partie fixe sur la liaison de communications, d'où il résulte que des instructions de guidage peuvent être communiquées à l'utilisateur au moyen du moyen d'instructions de guidage.

22. Système selon la revendication 18, 19, 20 ou 21, lorsqu'elle dépend de la revendication 15, dans lequel la partie mobile comprend un codeur multi-fréquence à double tonalité (DTMF) (8) destiné à convertir des données sous un format de code DTMF pour une transmission vers la partie fixe.

23. Système selon la revendication 22, dans lequel l'unité mobile comporte un moyen (6) destiné à convertir des données se rapportant à sa position sous un format de code DTMF, et la partie fixe comporte un moyen (12, 14) destiné à recevoir et à traiter lesdites données.

24. Système selon l'une quelconque des revendications 18 à 23, lorsqu'elle dépend de la revendication 14, comprenant un décodeur multi-fréquence à double tonalité (DTMF)(5) destiné à recevoir des données sous un format de code DTMF de la partie fixe.

25. Unité mobile destinée à un système d'informations de navigation, comprenant un moyen (7) destiné à identifier la position actuelle de l'unité mobile, un moyen (8, 10, 1) destiné à transmettre, sur une liaison de communications (11), des informations se rapportant à la localisation actuelle de l'unité mobile, et un moyen d'instructions de guidage (6) qui peut être commandé par des informations d'instructions de guidage reçues sur la liaison de communications, d'où il résulte que des instructions de guidage liées à la localisation actuelle peuvent être communiquées à un utilisateur au moyen du moyen d'instructions de guidage,

caractérisée en ce que l'unité mobile comporte un moyen (6) destiné à générer une demande de guidage liée à une destination spécifiée, et à recevoir un moyen d'instructions de guidage conformément à la localisation actuelle et à la destination spécifiée.

26. Unité mobile selon la revendication 25, comprenant un moyen (7) destiné à mesurer la localisation de l'unité mobile, et un moyen de mesure de l'heure, afin d'obtenir des informations de mouvement, un moyen destiné à comparer les informations de mouvement à une plage prévue reçue d'une partie fixe du système, et un moyen destiné à signaler automatiquement au système fixe des mesures de mouvement à l'extérieur de la plage prévue.

27. Unité mobile selon la revendication 25 ou 26, comprenant un codeur multi-fréquence à double tonalité (DTMF)(8) destiné à convertir des données en signaux de code DTMF pour une transmission.

28. Unité mobile selon la revendication 27, comportant un moyen (6) destiné à convertir des données se rapportant à sa position sous un format de code DTMF.

29. Unité mobile selon la revendication 25, 26, 27 ou 28, comprenant un décodeur multi-fréquence à double tonalité (DTMF)(5) destiné à recevoir des données sous un format de code DTMF.

30. Procédé consistant à fournir des informations de guidage de navigation à des unités mobiles d'un système radio mobile, les informations dépendant des localisations des unités mobiles, le procédé comprenant les étapes consistant à :

- transmettre, à partir d'une unité mobile (1) vers une partie fixe (11 à 20), une demande de guidage de navigation,
- déterminer la localisation de l'unité mobile,
- générer des informations de guidage sur la base des informations de localisation et des données de navigation mémorisées dans la partie fixe, et
- transmettre les informations de guidage depuis la partie fixe vers l'unité mobile,

caractérisé en ce que la demande d'informations de navigation comprend une destination spécifiée, et les informations de guidage générées sont sélectionnées conformément aux informations de localisation et à la destination demandée,

d'où il résulte que les informations de guidage concernant la localisation actuelle et la destination spécifiée de l'unité mobile, sont transmises à l'unité mobile.

31. Procédé selon la revendication 30, dans lequel la localisation de l'unité mobile st déterminé en relation avec une couverture géographique (40 à 49) comprenant une pluralité de zones de couverture, en générant des informations associées à une zone de couvertur qui comprend la localisation de la partie mobile, et en transmettant les informations associées à la zone de couverture concernée vers la partie mobile, d'où il résulte qu'une partie mobile à l'intérieur de cette zone de couverture reçoit des informations associées à cette zone de couverture.

32. Procédé selon la revendication 31, comprenant l'étape consistant à mémoriser une représentation numérique de la couverture géographique, et à modifier la représentation mémorisée de façon à ce que les configurations des zones de couverture puissent être sélectionnées pour satisfaire des exigences variables.

33. Procédé selon la revendication 31 ou 32, comprenant les étapes supplémentaires consistant à déterminer quand une unité mobile entre dans une zone de couverture prédéterminée (Si), et à transmettre un message à l'unité mobile en réponse au fait que l'unité mobile entre dans la zone de couverture prédéterminée.

34. Procédé selon la revendication 31, 32 ou 33 comprenant les étapes supplémentaires consistant à déterminer quand une unité mobile entre dans une zone de couverture prédéterminée, et à transmettre un message à un utilisateur autre que ladite unité mobile, en réponse au fait que l'unité mobile entre dans la zone de couverture prédéterminée.

35. Procédé selon la revendication 33 ou 34, comprenant l'étape supplémentaire consistant à modifier une valeur mémorisée associée à l'unité mobile en réponse au message.

36. Procédé selon l'une quelconque des revendications 30 à 35, dans lequel la position de l'unité mobile est identifiée par un procédé de localisation radio.

37. Procédé selon la revendication 36, dans lequel la position de l'unité mobile est déterminée au moyen d'un système de navigation par satellite et/ou en identifiant la localisation de la partie mobile en relation avec des éléments de la partie fixe du système de communications.

38. Procédé selon l'une quelconque des revendications 30 à 37, dans lequel la partie fixe interroge l'unité mobile afin d'identifier sa localisation.

39. Procédé selon la revendication 38, dans lequel la partie fixe détermine la localisation approchée de la

partie mobile, et dans lequel la partie mobile répond à une demande de localisation provenant du moyen d'interrogation avec un signal de localisation non unique qui, en combinaison avec la localisation approchée déterminée par la partie fixe, détermine une localisation unique.

40. Procédé selon l'une quelconque des revendications 30 à 39, dans lequel l'unité mobile identifie sa position par navigation à l'estime.

41. Procédé selon l'une quelconque des revendications 30 à 40, comprenant les étapes consistant à générer et à entretenir des données sur la base des données de mouvement de véhicule obtenues à partir des informations d'heure et des mesures de position d'une pluralité des parties mobiles et/ou des estimations des localisations futures des parties mobiles sur la base des informations de guidage transmises préalablement aux parties mobiles.

42. Procédé selon l'une quelconque des revendications 30 à 41, dans lequel la partie fixe transmet à la partie mobile une plage prévue d'informations de mouvement, et la partie mobile mesure la localisation et l'heure afin d'obtenir des informations de mouvement, compare les informations de mouvement à la plage prévue reçue depuis la partie fixe du système, et signale au système fixe les mesures de mouvement à l'extérieur de la plage prévue.

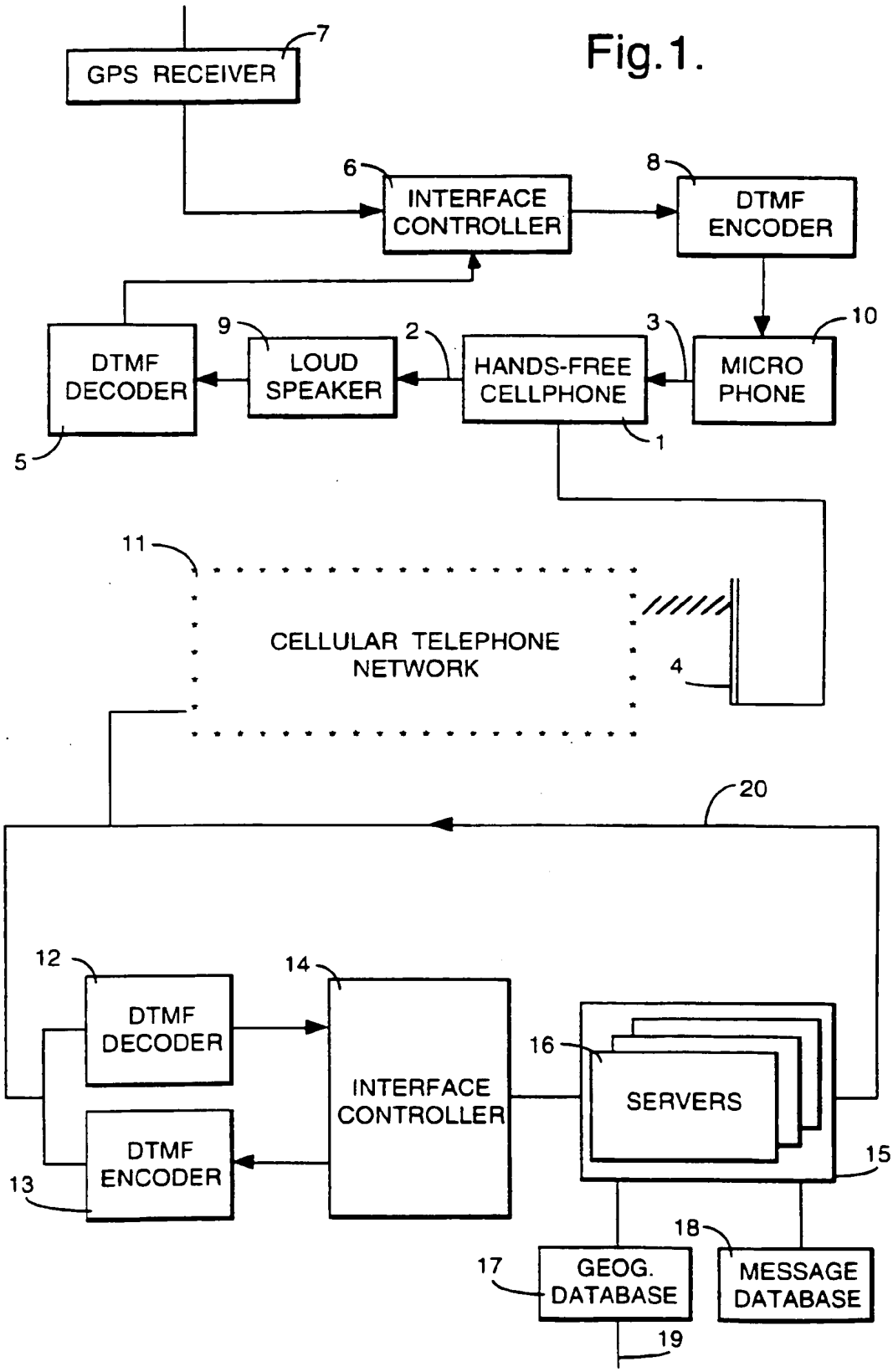
43. Procédé selon l'une quelconque des revendications 30 à 42, comprenant les étapes supplémentaires de mise à jour des données mémorisées, en identifiant les unités mobiles auxquelles les données mises à jour sont applicables, et en transmettant de telles données sur le système de communications vers lesdites parties mobiles concernées.

44. Procédé selon l'une quelconque des revendications 30 à 43, dans lequel les informations de guidage transmises à l'unité mobile commandent le moyen d'instructions de guidage (9) qui fait partie de l'unité mobile, d'où il résulte que des instructions de guidage peuvent être communiquées à l'utilisateur de l'unité mobile.

45. Procédé selon l'une quelconque des revendications 30 à 44, dans lequel au moins une partie des communications entre le mobile et les parties fixes se fait au moyen de signaux multi-fréquence à double tonalité (DTMF).

46. Système selon la revendication 45, dans lequel les informations se rapportant à la position de l'unité mobile sont transmises sous un format de code DTMF.

Fig.1.


GPS RECEIVER
7
INTERFACE CONTROLLER
6
DTMF ENCODER
8
DTMF DECODER
5
LOUD SPEAKER
9
HANDS-FREE CELLPHONE
2
1
MICRO PHONE
3
10
CELLULAR TELEPHONE NETWORK
11
4
20
DTMF DECODER
12
DTMF ENCODER
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INTERFACE CONTROLLER
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SERVERS
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15
GEOG. DATABASE
17
MESSAGE DATABASE
18
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Fig.2.

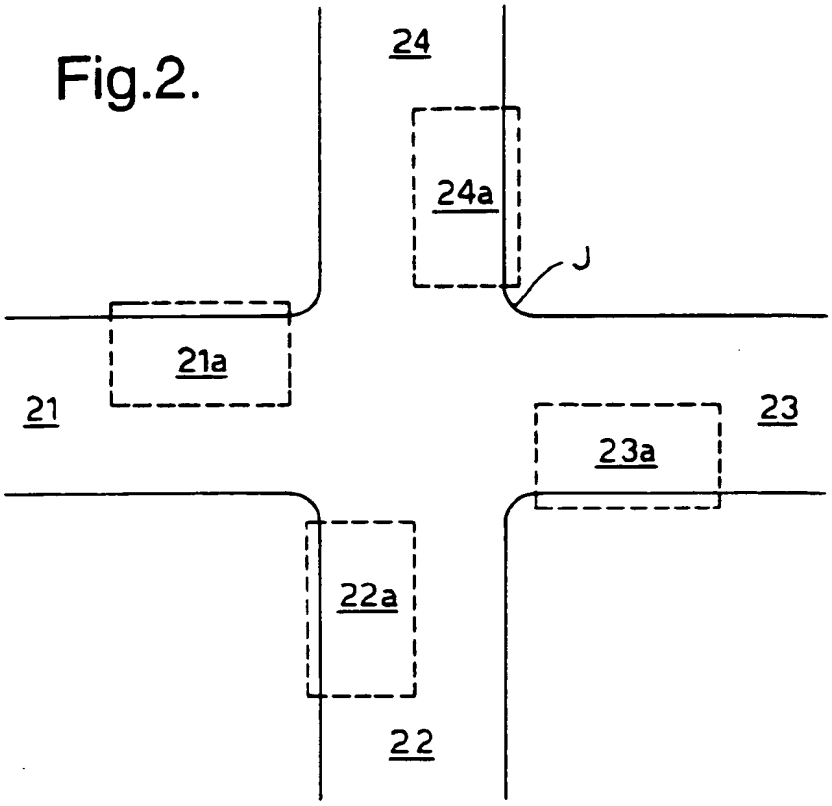
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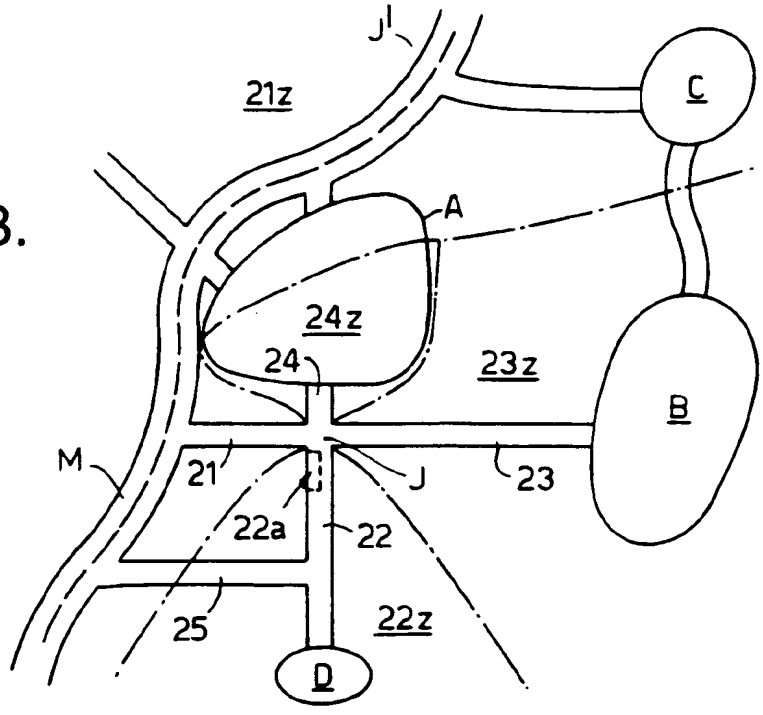
Fig.3.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D

Fig.4.

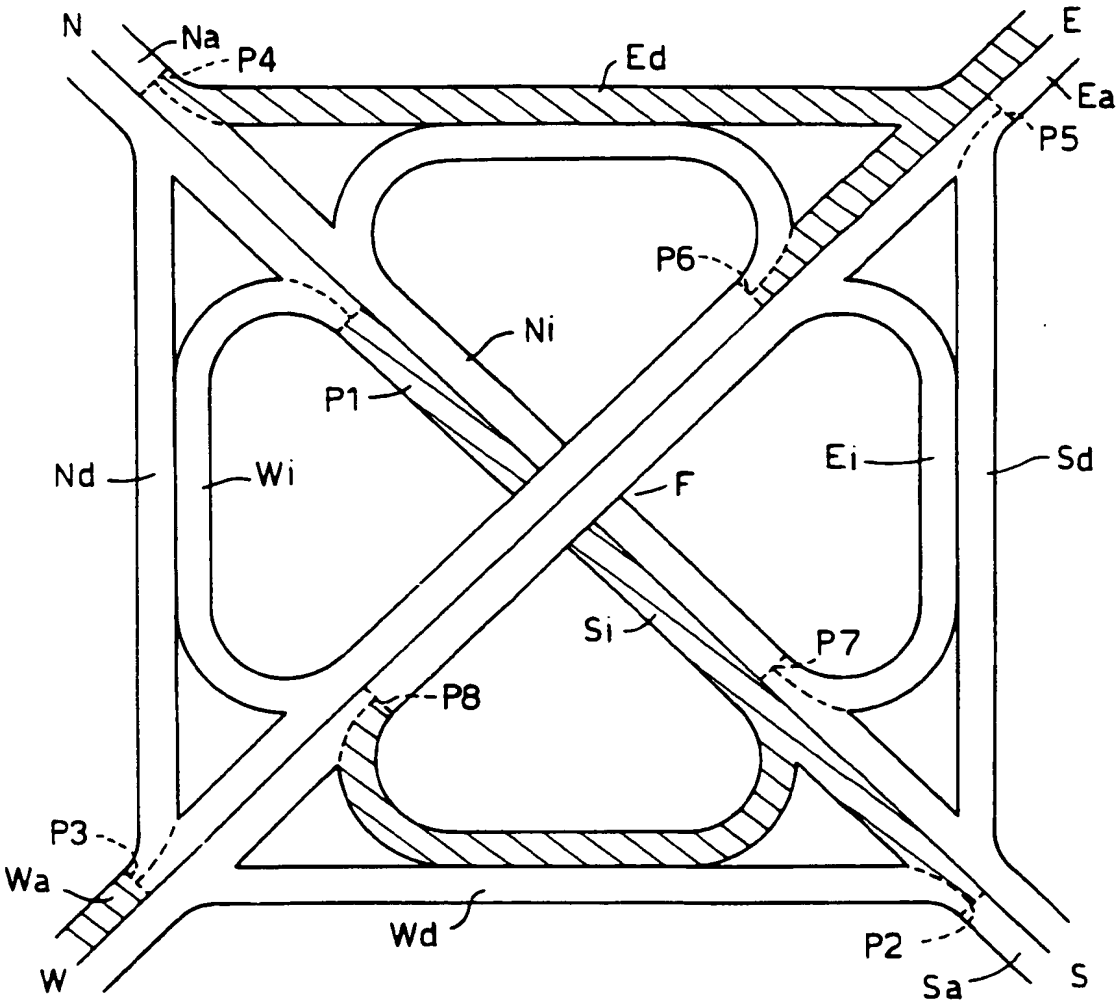

Fig.5a.

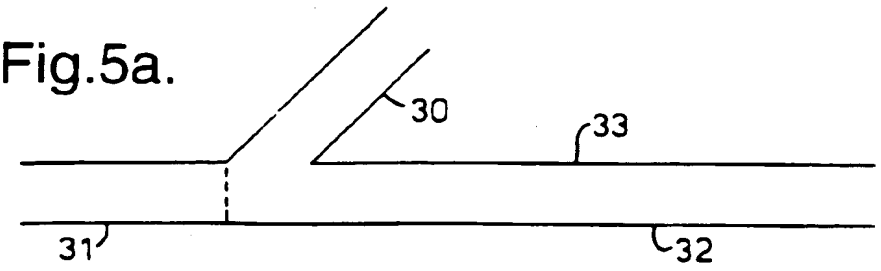

Fig.5b.

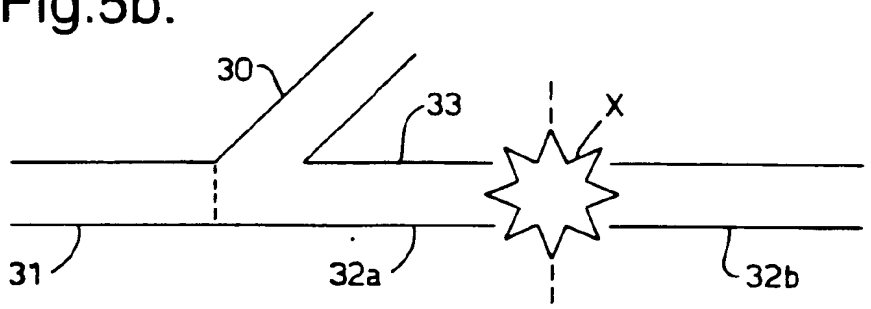
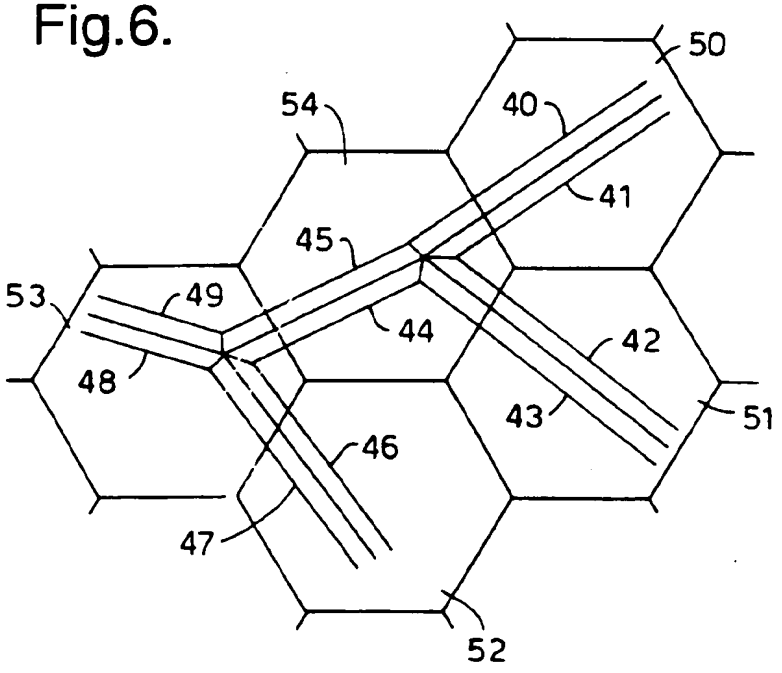
Fig.6.